General

Guideline Title

An evidence-based approach to patient selection for emergency department thoracotomy: a practice management guideline from the Eastern Association for the Surgery of Trauma.

Bibliographic Source(s)

Seamon MJ, Haut ER, Van Arendonk K, Barbosa RR, Chiu WC, Dente CJ, Fox N, Jawa RS, Khwaja K, Lee JK, Magnotti LJ, Mayglothling JA, McDonald AA, Rowell S, To KB, Falck-Ytter Y, Rhee P. An evidence-based approach to patient selection for emergency department thoracotomy: a practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg. 2015 Jul;79(1):159-73. [93 references] PubMed

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

The strength of recommendation (strong or weak/conditional) and levels of evidence (high, moderate, low or very low) are defined at the end of the "Major Recommendations" field.

Population, Intervention, Comparator, and Outcome (PICO) Question 1

In patients presenting pulseless to the emergency department with signs of life after penetrating thoracic injury (P), does emergency department thoracotomy (EDT) versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

Despite moderate overall quality of evidence (see Fig. 1 in the original guideline document) for both critical outcomes, subcommittee panelists believed that patients would strongly favor undergoing EDT in this clinical scenario because of the substantial improvements in both survival and neurologically intact survival over patients resuscitated without EDT. For these reasons, a strong recommendation was made, implying that most patients would want the recommended course of action and only a small proportion would not.

In patients presenting pulseless to the emergency department with signs of life after penetrating thoracic injury, the panel strongly recommends that patients undergo EDT. This recommendation is based on moderate quality of evidence and places emphasis on patient preference for improved

survival and neurologically intact survival after EDT.

PICO Question 2

In patients presenting pulseless to the emergency department without signs of life after penetrating thoracic injury (P), does EDT versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

Despite moderate overall quality of evidence for both critical outcomes (see Fig. 2 in the original guideline document) subcommittee panelists believed that a majority of patients would favor undergoing EDT in this clinical scenario because of the improvements in both survival and neurologically intact survival over patients resuscitated without EDT. The panel recognizes that the duration of time without signs of life is a vital component to the decision-making process, but an evidentiary basis for exact length of arrest times is extremely limited. For these reasons, a conditional recommendation is made, implying that, although most patients would want the recommended course of action, others would not.

In patients presenting pulseless to the emergency department without signs of life after penetrating thoracic injury, the panel conditionally recommends that patients undergo EDT. This recommendation is based on moderate quality of evidence and places emphasis on patient preference for improved survival and neurologically intact survival after EDT but also acknowledges that elapsed time without signs of life is an important component.

PICO Question 3

In patients presenting pulseless to the emergency department with signs of life after penetrating extrathoracic injury (P), does EDT versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

Despite moderate overall quality of evidence for both critical outcomes (see Fig. 3 in original guideline document), subcommittee panelists believed that a majority of patients would favor undergoing EDT in this clinical scenario because of the improvements in both survival and neurologically intact survival over patients resuscitated without EDT. The panel recognizes that all extrathoracic injury locations such as the neck, abdomen, and extremities may not have equivalent salvage rates after EDT. For these reasons, a conditional recommendation is made.

In patients presenting pulseless to the emergency department with signs of life after penetrating extrathoracic injury, the panel conditionally recommends that patients undergo EDT. This recommendation does not pertain to patients with isolated cranial injuries. This recommendation is based on moderate quality of evidence and places emphasis on patient preference for improved survival and neurologically intact survival after EDT but also acknowledges that penetrating injuries to all extrathoracic anatomic areas will not have equivalent salvage rates after EDT.

PICO Question 4

In patients presenting pulseless to the emergency department without signs of life after penetrating extrathoracic injury (P), does EDT versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

Although all voting members of the subcommittee sought a conditional recommendation, 11 members voted in favor of EDT and 4 voted against the procedure based on the PICO No. 4 Evidence Profile. Group disagreement and low quality of evidence for both critical outcomes (see Fig. 4 in original guideline document) led to a conditional recommendation.

In patients presenting pulseless to the emergency department without signs of life after penetrating extrathoracic injury, the panel conditionally recommends that patients undergo EDT. This recommendation does not pertain to patients with isolated cranial injuries and is based on low quality of evidence. The majority of subcommittee members believed that most patients would prefer undergoing EDT in hopes of improved survival and neurologically intact survival.

PICO Question 5

In patients presenting pulseless to the emergency department with signs of life after blunt injury (P), does EDT versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

With a moderate overall quality of evidence for both critical outcomes (see Fig. 5 in the original guideline document), subcommittee panelists

believed that most patients would favor undergoing EDT in this clinical scenario because of the improvements in both survival and neurologically intact survival over patients resuscitated without EDT. However, the subcommittee recognizes that many patients would not want to undergo EDT after blunt injury because of the possibility of concomitant severe traumatic brain injury and poor neurologic outcome in survivors.

In patients presenting pulseless to the emergency department with signs of life after blunt injury, the panel conditionally recommends that patients undergo EDT. This recommendation is based on moderate quality of evidence and places emphasis on patient preference for improved survival and neurologically intact survival after EDT.

PICO Question 6

In patients presenting pulseless to the emergency department without signs of life after blunt injury (P), does EDT versus resuscitation without EDT (C) improve hospital survival and neurologically intact hospital survival (O)?

Recommendation

Although subcommittee members unanimously voted against the performance of EDT based on the PICO No. 6 Evidence Profile, 10 members voted for a "strong" recommendation and 5 voted for a "conditional" recommendation. Group disagreement regarding the recommendation strength and low quality of evidence for both critical outcomes (see Fig. 6 in original guideline document) led to a conditional recommendation. Subcommittee panelists believed that a majority of patients would not favor undergoing EDT in this clinical scenario because of the dismal survival and likelihood of poor neurologic outcome.

In patients presenting pulseless to the emergency department without signs of life after blunt injury, the panel conditionally recommends against the performance of EDT. This recommendation is based on low quality of evidence and reflects subcommittee group disagreement regarding the strength of the unanimous recommendation against EDT.

Definitions

Grading of Recommendations Assessment, Development and Evaluation (GRADE) Methodology Levels for Rating the Quality of Evidence

Quality Level	Definitions
High	Very confident that the true effect lies close to estimate of effect.
Moderate	Moderate effect; true effect is likely close to estimate of effect but may be substantially different.
Low	Limited confidence; true effect may be substantially different from estimate of effect.
Very Low	Little confidence; true effect likely substantially different from estimate of effect.

GRADE Definition of Strong and Weak Recommendation

	Strong Recommendation	Weak/Conditional Recommendation
For patients	Most patients would want the recommended course of action.	Most patients would want the recommended course of action, but many would not.
For clinicians	Most patients should receive the recommended course of action.	Different choices will exist for different patients, and clinicians should help patients decide.
For policy makers	Recommended course should be adopted as policy.	Considerable debate and stakeholder involvement needed to make policy.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Critical injury requiring resuscitation

Guideline Category

Evaluation

Treatment

Clinical Specialty

Critical Care

Emergency Medicine

Intended Users

Physicians

Guideline Objective(s)

- To provide clear evidence-based recommendations for the physician facing the most common presenting clinical scenarios after critical injury
- To provide an evidence-based framework from which clinicians can make rapid decisions regarding further resuscitation with emergency department thoracotomy (EDT) or futility
- To evaluate whether EDT (vs. resuscitation without EDT) improves outcomes in patients who present to the hospital pulseless after critical injuries

Target Population

- Patients presenting pulseless to the emergency department with signs of life after penetrating thoracic injury
- Patients presenting pulseless to the emergency department without signs of life after penetrating thoracic injury
- Patients presenting pulseless to the emergency department with signs of life after penetrating extrathoracic injury
- Patients presenting pulseless to the emergency department without signs of life after penetrating extrathoracic injury
- Patients presenting pulseless to the emergency department with signs of life after blunt injury
- Patients presenting pulseless to the emergency department without signs of life after blunt injury

Interventions and Practices Considered

Emergency department thoracotomy (EDT)

Major Outcomes Considered

- Hospital survival
- Neurologically intact hospital survival

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Inclusion Criteria for This Review

Study Types

For the purposes of making recommendations, studies included prospective observational or retrospective studies without controls and case series.

Participant Types

All patients who underwent emergency department thoracotomy (EDT) regardless of age, sex, ethnicity, or comorbidities were included. Only studies that involved resuscitative EDT were included, whereas those involving either prehospital resuscitative thoracotomy or operating room thoracotomy were excluded from the analysis. Meta analyses, reviews without original data, case reports, and letters were excluded.

Intervention Type

The authors included studies in which EDT was performed in the above populations with the above measured outcomes. No direct comparator population exists in the literature; therefore, baseline risk of hospital survival for patients presenting pulseless to the emergency department with each of the above conditions was estimated by the subcommittee as presented in the Evidence Profiles.

Outcome Measure Types

Relevant outcomes including hospital survival, neurologically intact hospital survival, health care personnel exposure to blood-borne pathogens, and costs were independently rated by each individual member of the subcommittee. Only hospital survival and neurologically intact hospital survival were deemed "critical" outcomes necessary to decision making, whereas blood-borne pathogen exposure was "moderately" important and costs were of minimal importance to the group. However, the authors recognize that exposure is an important consideration for many clinicians when deciding whether or not to perform an EDT and a review of the topic is included in the present article for reference.

Review Methods

Electronic Search

A systematic search using the PubMed and EMBASE databases was performed using the following combination of the Medical Subject Headings (MESH) terms and related key words: thoracotomy, emergency medical services, emergency treatment, emergencies, emergency room, emergency department, emergency service, and emergency ward. The guideline committee included only articles available in English. Bibliographies of included studies were also reviewed to find potential additional articles for study inclusion.

Study Selection

Titles and abstracts from the electronic search were screened for relevance to each Population, Intervention, Comparator, and Outcome (PICO) question. Studies initially deemed relevant for inclusion then underwent full text review by the subcommittee to determine final appropriateness for inclusion.

Study Definition: Signs of Life

Signs of life, often used interchangeably with vital signs, were defined for the present study as defined by American College of Surgeons Committee on Trauma in 2001. Signs of life were considered present with any of the following: pupillary response, spontaneous ventilation, presence of carotid pulse, measureable or palpable blood pressure, extremity movement, or cardiac electrical activity.

Results

The literature search yielded 2,152 studies of which 2,031 were removed after title and abstract review. The subcommittee reviewed 121 full articles of which 48 were excluded (24 operating room thoracotomy studies, 8 prehospital resuscitative thoracotomy studies, 16 studies did not

address PICO questions or chosen outcomes).

Number of Source Documents

Ultimately, 72 studies were used in this guideline for recommendations. See the supplemental digital content (see the "Availability of Companion Documents" field) for a PRISMA flow diagram of the systematic review phases.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Grading of Recommendations Assessment, Development and Evaluation (GRADE) Methodology Levels for Rating the Quality of Evidence

Quality Level	Definitions
High	Very confident that the true effect lies close to estimate of effect.
Moderate	Moderate effect; true effect is likely close to estimate of effect but may be substantially different.
Low	Limited confidence; true effect may be substantially different from estimate of effect.
Very Low	Little confidence; true effect likely substantially different from estimate of effect.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Review Methods

Data Extraction and Management

Data were extracted using a standardized Microsoft Excel spreadsheet and consisted of the study authors, location, publication year, journal, methodology, and the relevant outcome measures with respect to emergency department thoracotomy (EDT) survival predictors. All entered data were checked in triplicate to ensure accuracy.

Assessment of Methodological Quality

The articles were evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system and documented in each Evidence Profile figure. The quality of evidence was evaluated for each of the following domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias.

Measures of Treatment Effect

Data on hospital survival and neurologically intact survival after EDT were collected from the included studies. The 95% confidence intervals for these event rates were calculated using the exact mid-P method. As described, no comparison or control group (i.e., no survival or neurologically intact survival data for similar groups of patients who did not undergo EDT) was available for the Population, Intervention, Comparator, Outcomes (PICO) questions of interest and prompted thorough consultation with GRADE methodology experts. Relative effects and risk differences were then estimated by comparing the event rates with EDT with the expected probability of survival without EDT as estimated by the subcommittee. To this end, individual subcommittee members were polled to predict patient survival without EDT but with standard resuscitation including large bore access, blood product and crystalloid infusion, thoracostomy tube placement, and emergent transport to the operative suite as necessary for each PICO. One high and low outlier response was excluded for each PICO and the remaining responses used to calculate the mean estimated

probability of survival without EDT. These estimates were then presented as the comparison group for each PICO. Without a control group in each constituent study, meta-analyses, assessments of heterogeneity, and confidence intervals for relative treatment effects were not calculable as a result.

Before evaluating the combinations of survival predictors for each PICO question, an analysis of each individual EDT survival predictor alone was undertaken across all 72 studies and presented in Table 1 in the original guideline document.

Please refer to the original guideline document for details of the qualitative synthesis performed for each PICO question.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Within the GRADE (Grading of Recommendations Assessment, Development and Evaluation) framework, the committee performed a systematic review and developed evidence-based recommendations to answer the following PICO (Population, Intervention, Comparator, Outcomes) question: should patients who present pulseless after critical injuries (with and without signs of life after penetrating thoracic, extrathoracic, or blunt injuries) undergo emergency department thoracotomy (EDT) (vs. resuscitation without EDT) to improve survival and neurologically intact survival?

The PICO questions were as follows:

Population

1. Patients presenting pulseless to the emergency department with signs of life after penetrating thoracic injury
2. Patients presenting pulseless to the emergency department without signs of life after penetrating thoracic injury
3. Patients presenting pulseless to the emergency department with signs of life after penetrating extrathoracic injury
4. Patients presenting pulseless to the emergency department without signs of life after penetrating extrathoracic injury
5. Patients presenting pulseless to the emergency department with signs of life after blunt injury
6. Patients presenting pulseless to the emergency department without signs of life after blunt injury

Intervention: EDT

Comparator: Resuscitation without EDT

Outcomes:

1. Hospital survival
2. Neurologically intact hospital survival

The strength of recommendations was based on the quality of evidence, risk-versus-benefit ratio, and patient values/preferences and was classified as "strong" (prefaced by "strongly recommend") or "weak" (prefaced by "conditionally recommend").

Rating Scheme for the Strength of the Recommendations

Grading of Recommendations Assessment Development, and Evaluation (GRADE) Definition of Strong and Weak Recommendation

	Strong Recommendation	Weak/Conditional Recommendation
For patients	Most patients would want the recommended course of action.	Most patients would want the recommended course of action, but many would not.
For clinicians	Most patients should receive the recommended course of action.	Different choices will exist for different patients, and clinicians should help patients decide.
For policy makers	Recommended course should be adopted as policy.	Considerable debate and stakeholder involvement needed to make policy.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Peer Review

Description of Method of Guideline Validation

Not stated

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate selection of patients who may benefit from emergency department thoracotomy (EDT) by survival and neurologically intact survival

Potential Harms

- When treating moribund trauma victims presenting in extremis, clinicians are forced to make immediate life-or-death decisions for their patients—decisions that attempt to balance the last chance of survival with the risk of salvaging patients with severe anoxic encephalopathy or exposing health care providers to blood-borne pathogens.
- When needlestick or cut exposure transmission rates (human immunodeficiency virus [HIV], 0.3%; hepatitis B virus [HBV], 6% to 30%; hepatitis C virus [HCV], 1.8% [0% to 7%]) from known seropositive blood are considered, it is imperative that universal precautions are maintained for all resuscitations.

Qualifying Statements

Qualifying Statements

- The Eastern Association for the Surgery of Trauma (EAST) is a multi-disciplinary professional society committed to improving the care of injured patients. The Ad Hoc Committee for Practice Management Guideline Development of EAST develops and disseminates evidence-based information to increase the scientific knowledge needed to enhance patient and clinical decision-making, improve health care quality, and promote efficiency in the organization of public and private systems of health care delivery. Unless specifically stated otherwise, the opinions expressed and statements made in this publication reflect the authors' personal observations and do not imply endorsement by nor official policy of EAST.
- "Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances."* These guidelines are not fixed protocols that must be followed, but are intended for health care professionals and providers to consider. While they identify and describe generally recommended courses of intervention, they are not presented as a substitute for the advice of a physician or other knowledgeable health care professional or provider. Individual patients may

require different treatments from those specified in a given guideline. Guidelines are not entirely inclusive or exclusive of all methods of reasonable care that can obtain/produce the same results. While guidelines can be written that take into account variations in clinical settings, resources, or common patient characteristics, they cannot address the unique needs of each patient nor the combination of resources available to a particular community or health care professional or provider. Deviations from clinical practice guidelines may be justified by individual circumstances. Thus, guidelines must be applied based on individual patient needs using professional judgment

- These guidelines represent a very detailed summary of the literature regarding emergency department thoracotomy (EDT) after six common clinical presentation scenarios. The vast majority of studies used within these guidelines are from major urban Trauma Centers—as such, their data and the resulting recommendations may not be applicable to community or rural centers. The guidelines are intended to inform the decision-making process rather than replace clinical judgment.

*Institute of Medicine. Clinical practice guidelines: directions for a new program. MJ Field and KN Lohr (eds) Washington, DC: National Academy Press. 1990: pg 39.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Staff Training/Competency Material

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

End of Life Care

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Seamon MJ, Haut ER, Van Arendonk K, Barbosa RR, Chiu WC, Dente CJ, Fox N, Jawa RS, Khwaja K, Lee JK, Magnotti LJ, Mayglothling JA, McDonald AA, Rowell S, To KB, Falck-Ytter Y, Rhee P. An evidence-based approach to patient selection for emergency department thoracotomy: a practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg. 2015 Jul;79(1):159-73. [93 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2015 Jul

Guideline Developer(s)

Eastern Association for the Surgery of Trauma - Professional Association

Source(s) of Funding

None

Guideline Committee

Eastern Association for the Surgery of Trauma (EAST) Practice Management Guidelines Section

Composition of Group That Authored the Guideline

Authors: Mark J. Seamon, MD; Elliott R. Haut, MD, PhD; Kyle Van Arendonk, MD; Ronald R. Barbosa, MD; William C. Chiu, MD; Christopher J. Dente, MD; Nicole Fox, MD; Randeep S. Jawa, MD; Kosar Khwaja, MD; J. Kayle Lee, MD; Louis J. Magnotti, MD; Julie A. Mayglothling, MD; Amy A. McDonald, MD; Susan Rowell, MD, MCR; Kathleen B. To, MD; Yngve Falck-Ytter, MD; Peter Rhee, MD, MPH

Financial Disclosures/Conflicts of Interest

The authors declare no conflicts of interest.

E.R.H. is the primary investigator of a contract (CE-12-11-4489) with The Patient Centered Outcomes Research Institute (PCORI) entitled "Preventing Venous Thromboembolism: Empowering Patients and Enabling Patient-Centered Care via Health Information Technology." E.R.H. receives royalties from Lippincott, Williams, Wilkins for the book *Avoiding Common ICU Errors*. E.R.H. is a paid speaker and consultant for the "Preventing Avoidable Venous Thromboembolism—Every Patient, Every Time" VHA IMPERATIV Advantage Performance Improvement Collaborative. E.R.H. is a member of the Eastern Association for the Surgery of Trauma (EAST) Board of Directors and was the former Chair of the EAST Guidelines Section.

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the Eastern Association for the Surgery of Trauma (EAST) Web site .

Availability of Companion Documents

The following are available:

- An evidence-based approach to patient selection for emergency department thoracotomy: a practice management guideline from the Eastern Association for the Surgery of Trauma. Supplemental digital content. 2015 Jul. Available from the Journal of Trauma and Acute Care Surgery Web site .
- Kerwin AJ, Haut ER, Burns JB, Como JJ, Haider A, Stassen N, Dahm P, Eastern Association for the Surgery of Trauma Practice Management Guidelines Ad Hoc Committee. The Eastern Association of the Surgery of Trauma approach to practice management guideline development using Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology. J Trauma Acute Care Surg. 2012 Nov;73(5 Suppl 4):S283-7. Available from the Eastern Association for the Surgery of Trauma (EAST) Web site .

In addition, a continuing medical education (CME) activity for this guideline is available in the original guideline document .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on November 3, 2015. The information was verified by the guideline developer on November 19, 2015.

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